

Research Note 82-10

AD A127416

BASELINE DATA, VOLUME 2:

RELATIVE FREQUENCY OF TYPES OF INFORMATION-SEEKING OR ERROR EVENTS
OCCURRING UNDER EACH TYPE OF TASK CONDITIONS

D. L. Schurman and A. J. Porsche
Applied Science Associates, Inc.

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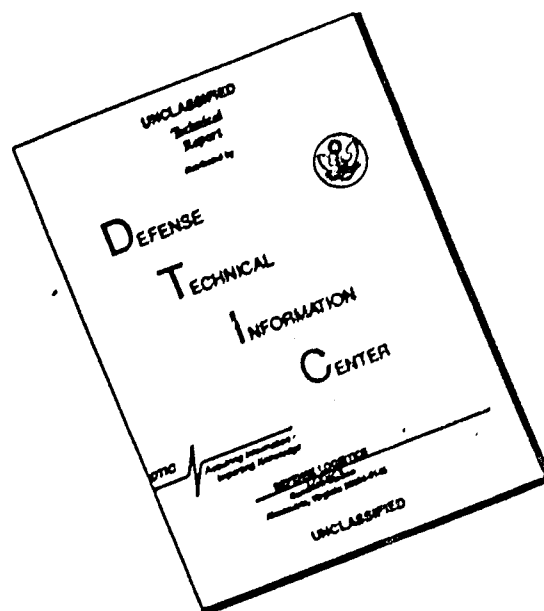
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September 1980

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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM										
1. REPORT NUMBER Research Note 82-10	2. GOVT ACCESSION NO. AD-A127416	3. RECIPIENT'S CATALOG NUMBER										
4. TITLE (and Subtitle) BASELINE DATA, VOLUME 2: RELATIVE FREQUENCY OF TYPES OF INFORMATION-SEEKING OR ERROR EVENTS OCCURRING UNDER EACH TYPE OF TASK CONDITIONS.		5. TYPE OF REPORT & PERIOD COVERED Interim, April 78 - September 80										
		6. PERFORMING ORG. REPORT NUMBER										
7. AUTHOR(s) D. L. Schurman A. J. Porsche		8. CONTRACT OR GRANT NUMBER(s) DAHC19-77-C-0025										
9. PERFORMING ORGANIZATION NAME AND ADDRESS Applied Science Associates, Inc. Box 178 Valencia, PA 16059		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS 20162722A777										
11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army Research Institute for the Behavioral and Social Sciences 5001 Eisenhower Ave., Alexandria, VA 22333		12. REPORT DATE 19 September 1980										
		13. NUMBER OF PAGES										
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		15. SECURITY CLASS. (of this report) Unclassified										
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE										
16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited												
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)												
18. SUPPLEMENTARY NOTES												
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) <table border="0"> <tr> <td>Mechanics' performance data</td> <td>Technical Manual Use</td> </tr> <tr> <td>Information needs</td> <td>Information types</td> </tr> <tr> <td>Maintenance errors</td> <td>Vehicle Maintenance</td> </tr> <tr> <td>Maintenance tasks</td> <td>Baseline performance</td> </tr> <tr> <td>Task characteristics</td> <td>Organizational maintenance</td> </tr> </table>			Mechanics' performance data	Technical Manual Use	Information needs	Information types	Maintenance errors	Vehicle Maintenance	Maintenance tasks	Baseline performance	Task characteristics	Organizational maintenance
Mechanics' performance data	Technical Manual Use											
Information needs	Information types											
Maintenance errors	Vehicle Maintenance											
Maintenance tasks	Baseline performance											
Task characteristics	Organizational maintenance											
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) <p>— Data on occurrence of information seeking and performance errors are presented for track and wheel vehicle mechanics classified by amount of prior task experience. Within this framework, information seeking behaviors are identified by type of information source used and type of information sought in relation to characteristics of the tasks performed. Error data is similarly displayed for type of performance error in relation to presence or absence of information seeking during the task performance and characteristics of the task performed.</p>												

20. (continued)

These data are based on unobtrusive observations of US Army mechanics performing their usual duties at their normal work sites. These observations were restricted to organizational-level motor pools and to mechanical repair tasks on vehicles in the M151 jeep series, M35 2 1/2-Ton truck series, M54 5-ton truck series, M113 armored personnel carrier series, and M60 tank series. Observers recorded the mechanics' performance in a step-by-step fashion, when information was sought during the performance and the errors made during the performance.

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PREFACE

This report represents 1 of 3 volumes of tables presenting data on mechanics use of job-site information sources and quality of their accompanying task performance under routine, work-site conditions. Each volume presents different information on this data base. The three volumes are:

Baseline data, Volume 1: Likelihood of occurrence (one or more times) of information-seeking or error events under different task conditions. This volume presents the data as a basis for estimating the probability or likelihood of mechanics using manuals or other information sources and making errors during performance of different types of tasks.

Baseline data, Volume 2: Relative frequency of types of information-seeking or error events occurring under each type of task condition. This volume provides a basis for focusing on the types of information sought and the types of errors made in relation to each of the different task characteristics and type of tasks identified.

Baseline data, Volume 3: Mean frequency for types of information-seeking or error events occurring under each type of task condition. Tables in this volume parallel those in Volume 2, but present, instead of relative frequencies, the average number of times information sources were used or errors were made by the mechanics who sought information or made errors during the work assignment.

Data presented in the three volumes of this series are intended for use in identifying job-site information needs of organizational level mechanics. In addition, they are intended for future research use as baseline data in evaluating the impact of new job-site information sources and/or shop management practices on mechanics' performance.

Data in these volumes were collected as part of a research project addressing the following two major objectives:

1. develop a method for evaluating use and effectiveness of manuals and other sources of work-site information used by mechanics under routine work-site conditions.
2. develop methods to improve prediction of mechanics' work-site information needs.

During this research a method was developed for observing and recording mechanics performing tasks assigned to them under the usual assignment practices employed in their shops. The observer did not intervene during task performance. No special arrangements were made to insure that the proper tools, manuals, or other resources were readily available to the mechanic while performing the assigned work. In other words, with the exception of the observer's presence, conditions were just as they would have been if the observer had not been present.

Before conducting the observations, detailed task analyses were developed on a large pool of tasks organizational level mechanics are expected to perform on five types of vehicles. The five types of vehicles were the M60 tank series, M113 armored personnel carrier series, M151 jeep series, M35 2½-ton truck series, and the M54 5-ton truck series. During the task performance the observer recorded a written description, in a step-by-step fashion, of:

1. activity being performed and how it was performed.
2. when information was sought in the context of the ongoing activity.
3. source and identity of information sought and obtained.
4. errors made (corrected, uncorrected and omissions).

Only tasks that directly involved mechanical maintenance were observed. Assignments that involved only inspection of equipment such as quarterly inspections were not observed for this purpose. With this exception, the tasks observed were sampled from the daily work load being performed in each shop. As a result, these observations are based on the commonly occurring, "bread and butter" tasks performed at the organizational maintenance level.

The 300 observations on which these volumes are based were obtained by observing 236 organizational level mechanics (MOS 63C and 63B) located in five US Army combat arms divisions. The observations were conducted during the fall to winter of 1978-1979 and again during the fall to winter of 1979-1980. The research and observational methodology upon which data in this and the remaining two volumes are based are described in the following reports:

Schurman, D.L., Porsche, A.J., & Joyce, R.P. Assessing use of information sources and quality of performance at the work site. Applied Science Associates, Inc., Valencia, PA, Report No. 604, December, 1980.

Schurman, D.L., Porsche, A.J., Garbin, C.P., & Joyce, R.P. Guidelines: Assessing use of information sources and quality of performance at the work site. Applied Science Associates, Inc., Valencia, PA, Report 603, December 1980.

Structure of the Baseline Tables In This Volume

The percentages presented in the following tables are based on the number of times (events) information was sought or errors were made during the 300 work assignments observed. These observations are distributed among the three "Prior Task Experience Levels" in the following manner: 7 or more (n=128; 1-6 (n=100); none (n=72).

For all of the tables in this volume percentages are based on total events for one level (easy/hard) of a single task characteristic, or on total events for a single task type. This number of total events is located at the top of each column. The column percentages will add up to 100 percent (within rounding error) since events unlike observations are mutually exclusive for sources, types and source by type. Rounding error may be as much as 3% because 0.5 was always rounded upward to the nearest whole number. .

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BASELINE DATA, MOS 63B/C, 1978-80

**RELATIVE FREQUENCY OF INFORMATION SEEKING EVENTS,
LISTED BY MAJOR INFORMATION SOURCE**
(Percent of Total Events at Each Level of Task Characteristic)

PRIOR TASK EXPERIENCE LEVEL: 7 OR MORE

Source From Which Information Sought	TASK CHARACTERISTICS													
	Visual Accessibility		Manual Accessibility		Clarity of Necessary Task Steps		Clarity of Techniques to Perform Task Steps		Special Tools Required		Formal Specs Required		Operational Check Required	
	Easy n= 89	Hard n= 64	Easy n= 72	Hard n= 81	Clear n= 81	Unclear n= 72	Clear n= 36	Unclear n= 117	None n= 68	One or More n= 85	None n= 82	One or More n= 71	None n= 23	One or More n= 130
Person - Ask (%)	42	56	44	51	40	57	33	52	46	49	46	49	30	51
Person - Discuss (%)	46	36	42	42	47	36	61	36	49	36	43	41	61	38
Printed Material (%)	12	8	14	7	14	7	6	12	6	14	11	10	9	11

*Caution: Percentage in this cell based on less than 10 cases

BASELINE DATA, MOS 63B/C, 1978-80

**RELATIVE FREQUENCY OF INFORMATION SEEKING EVENTS,
LISTED BY MAJOR INFORMATION SOURCE**
(Percent of Total Events at Each Level of Task Characteristic)

PRIOR TASK EXPERIENCE LEVEL: 1-6

Source From Which Information Sought	TASK CHARACTERISTICS													
	Visual Accessibility		Manual Accessibility		Clarity of Necessary Task Steps		Clarity of Techniques to Perform Task Steps		Special Tools Required		Formal Specs Required		Operational Check Required	
	Easy n= 91	Hard n=105	Easy n= 63	Hard n=133	Clear n=100	Unclear n=96	Clear n= 69	Unclear n=127	None n= 83	One or More n=113	None n= 38	One or More n=158	None n= 17	One or More n=179
Person - Ask (%)	52	44	52	45	53	42	52	45	57	41	55	46	47	47
Person - Discuss (%)	20	19	22	18	22	17	22	18	14	23	24	18	35	18
Printed Material (%)	29	37	25	37	25	42	26	37	29	36	21	36	18	35

*Caution: Percentages in this table may not add to 100 percent.

BASE LINE DATA MOS C3B/C, 1978-80

**RELATIVE FREQUENCY OF INFORMATION SEEKING EVENTS,
LISTED BY MAJOR INFORMATION SOURCE**
(Percent of Total Events at Each Level of Task Characteristic)

PRIOR TASK EXPERIENCE LEVEL: NONE

Source From Which Information Sought	TASK CHARACTERISTICS													
	Visual Accessibility		Manual Accessibility		Clarity of Necessary Task Steps		Clarity of Techniques to Perform Task Steps		Special Tools Required		Formal Specs Required		Operational Check Required	
	Easy n=67	Hard n=138	Easy n=43	Hard n=162	Clear n=95	Unclear n=110	Clear n=49	Unclear n=156	None n=71	One or More n=134	None n=73	One or More n=132	None n=39	One or More n=166
Person - Ask (%)	61	38	56	43	47	44	51	44	45	46	37	50	56	43
Person - Discuss (%)	21	26	16	27	20	28	20	26	17	28	32	20	33	22
Printed Material (%)	18	36	28	31	33	28	29	31	38	26	32	30	10	35

*Caution: Percentage in this cell based on less than 10 cases.

BASELINE DATA, MOS 63B/C, 1978-80

**RELATIVE FREQUENCY OF INFORMATION SEEKING EVENTS,
LISTED BY MAJOR INFORMATION SOURCE
(Percent of Total Events of Each Task Type)**

PRIOR TASK EXPERIENCE LEVEL: 7 OR MORE

Source From Which Information Sought	GENERAL TASK TYPES				
	Component Part Replacement n = 31	Preventive Maintenance n = 5	Drivetrain n = 1	Brake n = 62	Suspension and Wheel n = 54
Person - Ask (%)	35	40*	0*	53	50
Person - Discuss (%)	65	20*	100*	40	31
Printed Material (%)	0	40*	0*	6	19

* Caution: Percentage in this cell based on less than 10 cases.

BASELINE DATA, MOS 638/C, 1978-80

**RELATIVE FREQUENCY OF INFORMATION SEEKING EVENTS,
LISTED BY MAJOR INFORMATION SOURCE
(Percent of Total Events of Each Task Type)**

PRIOR TASK EXPERIENCE LEVEL: 1-8

Source From Which Information Sought	GENERAL TASK TYPES				
	Component Part Replacement n = 34	Preventive Maintenance n = 34	Drivetrain n = 14	Brake n = 69	Suspension and Wheel n = 45
Person - Ask (%)	32	30	57	54	60
Person - Discuss (%)	24	30	14	17	13
Printed Material (%)	44	41	29	29	27

*Caution: Percentage in this cell based on less than 10 cases

BASELINE DATA, MOS 63B/C, 1978-80
**RELATIVE FREQUENCY OF INFORMATION SEEKING EVENTS,
 LISTED BY MAJOR INFORMATION SOURCE**
 (Percent of Total Events of Each Task Type)

PRIOR TASK EXPERIENCE LEVEL: NONE

Source From Which Information Sought	GENERAL TASK TYPES				
	Component Part Replacement n = 49	Preventive Maintenance n = 27	Drivetrain n = 11	Brake n = 42	Suspension and Wheel n = 76
Person - Ask (%)	43	48	64	33	50
Person - Discuss (%)	37	22	9	10	28
Printed Material (%)	20	30	27	57	22

*Caution: Percentage in this cell based on less than 10 cases

BASFLINE DATA, MOS 63B/C 1978-80

**RELATIVE FREQUENCY OF INFORMATION SEEKING EVENTS,
LISTED BY MAJOR TYPE OF INFORMATION SOUGHT**
(Percent of Total Events At Each Level of Task Characteristic)

PRIOR TASK EXPERIENCE LEVEL: 7 OR MORE

Types of Information Sought	TASK CHARACTERISTICS													
	Visual Accessibility		Manual Accessibility		Clarity of Necessary Task Steps		Clarity of Techniques to Perform Task Steps		Special Tools Required		Formal Specs Required		Operational Check Required	
	Easy n=89	Hard n=64	Easy n=72	Hard n=81	Clear n=81	Unclear n=72	Clear n=36	Unclear n=117	None n=68	One or More n=85	None n=82	One or More n=71	None n=23	One or More n=130
Location/Identification of Components (%)	2	0	1	1	2	0	3	1	3	0	2	0	0	2
Technique for a Task Step (%)	54	30	54	35	54	32	44	44	29	55	48	39	74	38
Task Steps Required for Completion (%)	20	20	21	20	23	17	22	20	25	16	29	10	9	22
Formal Specification Data (%)	8	6	7	7	4	11	3	9	7	7	1	14	0	8
Help on Serviceability Judgement (%)	10	33	12	26	7	33	11	22	31	11	18	21	9	22
Help on Alignment Judgement (%)	6	11	4	11	9	7	17	5	4	11	1	15	9	8

*Caution: Percentage in this cell based on less than 10 cases.

BASELINE DATA, MOS 83B/C, 1978-80

**RELATIVE FREQUENCY OF INFORMATION SEEKING EVENTS,
LISTED BY MAJOR TYPE OF INFORMATION SOUGHT**
(Percent of Total Events At Each Level of Task Characteristic)

PRIOR TASK EXPERIENCE LEVEL: 1-6

Types of Information Sought	TASK CHARACTERISTICS													
	Visual Accessibility		Manual Accessibility		Clarity of Necessary Task Steps		Clarity of Techniques to Perform Task Steps		Special Tools Required		Formal Specs Required		Operational Check Required	
	Easy n=91	Hard n=105	Easy n=63	Hard n=133	Clear n=100	Unclear n=96	Clear n=69	Unclear n=127	None n=83	One or More n=113	None n=38	One or More n=158	None n=17	One or More n=179
Location/Identification of Components (%)	18	9	22	8	20	5	25	6	23	5	10	13	0	14
Technique for a Task Step (%)	46	48	43	49	42	52	41	50	33	58	45	47	71	45
Task Steps Required for Completion (%)	12	11	11	12	13	10	7	14	14	10	16	11	12	12
Formal Specification Data (%)	13	9	16	8	8	14	14	9	7	13	3	13	12	11
Help on Serviceability Judgement (%)	4	10	6	8	5	10	4	9	7	8	10	7	6	8
Help on Alignment Judgement (%)	7	13	2	14	12	8	9	11	16	6	16	9	0	11

*Caution: Percentage in this cell based on less than 10 cases.

BASELINE DATA, MOS 638/C, 1978-80

**RELATIVE FREQUENCY OF INFORMATION SEEKING EVENTS,
LISTED BY MAJOR TYPE OF INFORMATION SOUGHT
(Percent of Total Events At Each Level of Task Characteristic)**

PRIOR TASK EXPERIENCE LEVEL: NONE

Types of Information Sought	TASK CHARACTERISTICS													
	Visual Accessibility		Manual Accessibility		Clarity of Necessary Task Steps		Clarity of Techniques to Perform Task Steps		Special Tools Required		Formal Specs Required		Operational Check Required	
	Easy n= 67	Hard n=138	Easy n=43	Hard n=162	Clear n=95	Unclear n=110	Clear n=89	Unclear n=156	None n=71	One or More n=134	None n=73	One or More n=132	None n=39	One or More n=166
Location/Identification of Components (%)	9	6	12	6	8	6	8	7	10	6	12	5	5	8
Technique for a Task Step (%)	49	49	51	48	52	46	47	49	45	51	49	48	41	51
Task Steps Required for Completion (%)	25	24	26	24	24	25	23	25	28	22	23	25	31	23
Formal Specification Data (%)	6	14	9	12	11	12	16	10	11	11	11	11	8	12
Help on Serviceability Judgement (%)	7	4	2	6	4	5	6	4	4	5	3	6	8	4
Help on Alignment Judgement (%)	3	4	0	4	1	5	0	4	1	4	1	5	8	2

*Caution: Percentage in this cell based on less than 10 cases.

BASELINE DATA, MOS 638/C, 1978-80

**RELATIVE FREQUENCY OF INFORMATION SEEKING EVENTS,
LISTED BY MAJOR TYPE OF INFORMATION SOUGHT
(Percent of Total Events of Each Task Type)**

PRIOR TASK EXPERIENCE LEVEL: 7 OR MORE

Types of Information Sought	GENERAL TASK TYPES				
	Component Part Replacement n = 31	Preventive Maintenance n = 5	Drivetrain n = 1	Brake n = 62	Suspension and Wheel n = 54
Location/Identification of Components (%)	6	0*	0*	0	0
Technique for a Task Step (%)	39	40*	100*	29	63
Task Steps Required for Completion (%)	32	20*	0*	19	15
Formal Specification Data (%)	6	20*	0*	8	6
Help on Serviceability Judgement (%)	6	0*	0*	40	6
Help on Alignment Judgement (%)	10	20*	0*	3	11

*Caution: Percentage in this cell based on less than 10 cases

BASLINE DATA, MOS 638/C, 1978-80

**RELATIVE FREQUENCY OF INFORMATION SEEKING EVENTS,
LISTED BY MAJOR TYPE OF INFORMATION SOUGHT**
(Percent of Total Events of Each Task Type)

PRIOR TASK EXPERIENCE LEVEL: 1-6

Types of Information Sought	GENERAL TASK TYPES				
	Component Part Replacement n = 34	Preventive Maintenance n = 34	Drivetrain n = 14	Brake n = 69	Suspension and Wheel n = 45
Location/Identification of Components (%)	12	12	36	0	27
Technique for a Task Step (%)	53	53	29	51	38
Task Steps Required for Completion (%)	24	6	0	13	9
Formal Specification Data (%)	6	24	14	12	2
Help on Serviceability Judgement (%)	6	3	7	6	16
Help on Alignment Judgement (%)	0	3	14	19	9

*Caution: Percentage in this cell based on less than 10 cases.

BASELINE DATA, MOS 638/C, 1978-80

**RELATIVE FREQUENCY OF INFORMATION SEEKING EVENTS,
LISTED BY MAJOR TYPE OF INFORMATION SOUGHT**
(Percent of Total Events of Each Task Type)

PRIOR TASK EXPERIENCE LEVEL: NONE

Types of Information Sought	GENERAL TASK TYPES				
	Component Part Replacement n = 49	Preventive Maintenance n = 27	Drivetrain n = 11	Brake n = 42	Suspension and Wheel n = 76
Location/Identification of Components (%)	12	19	0	2	4
Technique for a Task Step (%)	45	44	27	48	57
Task Steps Required for Completion (%)	14	30	36	33	22
Formal Specification Data (%)	14	4	27	17	7
Help on Serviceability Judgement (%)	12	0	9	0	4
Help on Alignment Judgement (%)	2	4	0	0	7

*Caution: Percentages in this cell based on less than 10 cases

BASFLINE DATA, MOS 638/C, 1978-80

RELATIVE FREQUENCY OF INFORMATION SEEKING EVENTS - TYPE BY SOURCE
(Percent of Total Events At Each Level of Task Characteristic)

SOURCE: PERSON - ASK

PRIOR TASK EXPERIENCE LEVEL: 7 OR MORE

Types of Information Sought	TASK CHARACTERISTICS													
	Visual Accessibility		Manual Accessibility		Clarity of Necessary Task Steps		Clarity of Techniques to Perform Task Steps		Special Tools Required		Formal Specs Required		Operational Check Required	
	Easy n=37	Hard n=36	Easy n=32	Hard n=41	Clear n=32	Unclear n=41	Clear n=12	Unclear n=61	None n=31	One or More n=42	None n=38	One or More n=35	None n=7	One or More n=66
Location/Identification of Components (%)	3	0	3	0	3	0	8	0	3	0	3	0	0*	1
Technique for a Task Step (%)	43	17	44	20	47	17	33	30	13	43	37	23	43*	29
Task Steps Required for Completion (%)	19	11	19	12	22	10	8	16	13	17	26	3	0*	17
Formal Specification Data (%)	3	6	3	5	0	7	0	5	6	2	0	9	0*	5
Help on Serviceability Judgment (%)	22	53	25	46	16	54	25	39	58	21	34	40	29*	38
Help on Alignment Judgment (%)	11	14	6	17	12	12	25	10	6	17	0	26	29*	11

*Caution: Percentages in this cell based on less than 10 cases

BASELINE DATA, MOS 638/C, 1978-80

RELATIVE FREQUENCY OF INFORMATION SEEKING EVENTS - TYPE BY SOURCE
(Percent of Total Events At Each Level of Task Characteristic)

SOURCE: PERSON - ASK

PRIOR TASK EXPERIENCE LEVEL: 1-6

Types of Information Sought	TASK CHARACTERISTICS													
	Visual Accessibility		Manual Accessibility		Clarity of Necessary Task Steps		Clarity of Techniques to Perform Task Steps		Special Tools Required		Formal Specs Required		Operational Check Required	
	Easy n= 47	Hard n=46	Easy n= 33	Hard n= 60	Clear n=53	Unclear n=40	Clear n=36	Unclear n= 57	None n=47	One or More n=46	None n= 21	One or More n=72	None n= 8	One or More n=85
Location/Identification of Components (%)	19	7	24	7	19	5	25	5	19	7	5	15	0*	14
Technique for a Task Step (%)	40	13	36	37	32	42	33	39	28	46	33	37	50*	35
Task Steps Required for Completion (%)	11	4	12	5	11	2	6	9	9	7	14	6	25*	6
Formal Specification Data (%)	9	4	12	3	6	7	11	4	4	9	0	8	12*	6
Help on Serviceability Judgment (%)	9	22	12	17	9	22	8	19	13	17	19	14	12*	15
Help on Alignment Judgment (%)	13	30	3	32	23	20	17	25	28	15	29	19	0*	24

*Caption: Percentages in this cell based on less than 10 cases

BASELINE DATA, MOS 63B/C, 1978-80

RELATIVE FREQUENCY OF INFORMATION SEEKING EVENTS – TYPE BY SOURCE
(Percent of Total Events At Each Level of Task Characteristic)

SOURCE: PERSON – ASK

PRIOR TASK EXPERIENCE LEVEL: NONE

Types of Information Sought	TASK CHARACTERISTICS													
	Visual Accessibility		Manual Accessibility		Clarity of Necessary Task Steps		Clarity of Techniques to Perform Task Steps		Special Tools Required		Formal Specs Required		Operational Check Required	
	Easy n= 41	Hard n= 52	Easy n= 24	Hard n= 69	Clear n= 45	Unclear n= 48	Clear n= 25	Unclear n= 68	None n= 32	One or More n= 61	None n= 27	One or More n= 66	None n= 22	One or More n= 71
Location/Identification of Components (%)	10	5	12	6	11	4	12	6	9	7	11	6	9	7
Technique for a Task Step (%)	41	60	59	49	56	48	52	51	50	52	44	55	41	55
Task Steps Required for Completion (%)	27	10	25	14	20	15	2	15	28	11	30	12	18	17
Formal Specification Data (%)	5	5	0	7	2	8	0	7	0	8	4	6	5	6
Help on Serviceability Judgement (%)	12	10	4	13	9	12	12	10	9	11	7	12	14	10
Help on Alignment Judgement (%)	5	10	0	10	2	12	0	10	3	10	4	9	14	6

*Caution: Percentages in this cell based on less than 10 cases.

BASELINE DATA MOS 63B/C, 1978-80

RELATIVE FREQUENCY OF INFORMATION SEEKING EVENTS – TYPE BY SOURCE
(Percent of Total Events At Each Level of Task Characteristic)

SOURCE: PERSON – DISCUSS

PRIOR TASK EXPERIENCE LEVEL: 7 OR MORE

Types of Information Sought	TASK CHARACTERISTICS													
	Visual Accessibility		Manual Accessibility		Clarity of Necessary Task Steps		Clarity of Techniques to Perform Task Steps		Special Tools Required		Formal Specs Required		Operational Check Required	
	Easy n= 41	Hard n= 23	Easy n= 30	Hard n= 34	Clear n= 38	Unclear n= 26	Clear n= 22	Unclear n= 42	None n= 33	One or More n= 31	None n= 35	One or More n= 29	None n= 14	One or More n= 50
Location/Identification of Components (%)	2	0	0	3	3	0	0	2	3	0	3	0	0	2
Technique for a Task Step (%)	66	48	67	53	58	62	55	62	48	71	57	62	86	52
Task Steps Required for Completion (%)	22	35	23	29	26	27	27	26	33	19	31	21	14	30
Formal Specification Data (%)	5	0	3	3	3	4	0	5	3	3	0	7	0	4
Help on Serviceability Judgement (%)	2	9	3	6	3	8	5	5	9	0	6	3	0	6
Help on Alignment Judgement (%)	2	9	3	6	8	0	14	0	3	6	3	7	0	6

*Caution: Percentage in this cell based on less than 10 cases

PASELINE DATA, MOS 638/C, 1978-80

RELATIVE FREQUENCY OF INFORMATION SEEKING EVENTS – TYPE BY SOURCE
(Percent of Total Events At Each Level of Task Characteristic)

SOURCE: PERSON – DISCUSS

PRIOR TASK EXPERIENCE LEVEL: 1-6

Types of Information Sought	TASK CHARACTERISTICS													
	Visual Accessibility		Manual Accessibility		Clarity of Necessary Task Steps		Clarity of Techniques to Perform Task Steps		Special Tools Required		Formal Specs Required		Operational Check Required	
	Easy n= 18	Hard n= 20	Easy n= 14	Hard n= 24	Clear n=22	Unclear n=16	Clear n=15	Unclear n=23	None n=12	One or More n=26	None n= 9	One or More n=29	None n= 6	One or More n= 32
Location/Identification of Components (%)	6	5	7	4	9	0	0	9	8	4	11*	3	0*	6
Technique for a Task Step (%)	78	70	71	75	77	69	80	70	50	84	78*	73	100*	69
Task Steps Required for Completion (%)	11	20	14	17	14	19	13	17	33	8	11*	18	0*	19
Formal Specification Data (%)	6	0	7	0	0	6	6	0	8	0	0*	3	0*	3
Help on Serviceability Judgement (%)	0	5	0	4	0	6	0	4	0	4	0*	3	0*	3
Help on Alignment Judgement (%)	0	0	0	0	0	0	0	0	0	0	0*	0	0*	0

*Caution: Percentage in this cell based on less than 10 cases

BASELINE DATA, MOS 63B/C, 1978-80

RELATIVE FREQUENCY OF INFORMATION SEEKING EVENTS – TYPE BY SOURCE
(Percent of Total Events At Each Level of Task Characteristic)

SOURCE: PERSON – DISCUSS

PRIOR TASK EXPERIENCE LEVEL: NONE

Types of Information Sought	TASK CHARACTERISTICS													
	Visual Accessibility		Manual Accessibility		Clarity of Necessary Task Steps		Clarity of Techniques to Perform Task Steps		Special Tools Required		Formal Specs Required		Operational Check Required	
	Easy n= 14	Hard n= 36	Easy n= 7	Hard n= 43	Clear n=19	Unclear n= 31	Clear n=10	Unclear n= 40	None n=12	One or More n= 38	None n= 23	One or More n= 27	None n=13	One or More n= 37
Location/Identification of Components (%)	7	6	14*	5	5	6	10	5	8	5	4	7	0	8
Technique for a Task Step (%)	79	61	57*	67	68	65	70	65	50	71	70	63	38	76
Task Steps Required for Completion (%)	14	28	29*	23	16	29	0	30	25	24	17	30	54	14
Formal Specification Data (%)	0	6	0*	5	11	0	20	0	17	0	9	0	8	3
Help on Serviceability Judgement (%)	0	0	0*	0	0	0	0	0	0	0	0	0	0	0
Help on Alignment Judgement (%)	0	0	0*	0	0	0	0	0	0	0	0	0	0	0

*Caution: Percentage in this cell based on less than 10 cases.

BASELINE DATA, MOS 63B/C, 1978-80

RELATIVE FREQUENCY OF INFORMATION SEEKING EVENTS – TYPE BY SOURCE
(Percent of Total Events At Each Level of Task Characteristic)

SOURCE: PRINTED MATERIAL

PRIOR TASK EXPERIENCE LEVEL: 7 OR MORE

	TASK CHARACTERISTICS													
	Visual Accessibility		Manual Accessibility		Clarity of Necessary Task Steps		Clarity of Techniques to Perform Task Steps		Special Tools Required		Formal Specs Required		Operational Check Required	
Types of Information Sought	Easy n=11	Hard n=5	Easy n=10	Hard n=6	Clear n=11	Unclear n=5	Clear n=2	Unclear n=14	None n=4	One or More n=12	None n=9	One or More n=7	None n=2	One or More n=14
Location/Identification of Components (%)	0	0*	0	0*	0	0*	0*	0	0*	0	0*	0*	0*	0
Technique for a Task Step (%)	45	40*	50	33*	64	0*	0*	50	0*	58	56*	29*	100*	36
Task Steps Required for Completion (%)	18	20*	20	17*	18	20*	50*	14	50*	8	33*	0*	0*	21
Formal Specification Data (%)	36	40*	30	50*	18	80*	50*	36	50*	33	11*	71*	0*	43

*Caution: Percentage in this cell based on less than 10 cases

BASELINE DATA, MOS 63B/C, 1978-80

RELATIVE FREQUENCY OF INFORMATION SEEKING EVENTS – TYPE BY SOURCE
(Percent of Total Events At Each Level of Task Characteristic)

SOURCE: PRINTED MATERIAL

PRIOR TASK EXPERIENCE LEVEL: 1-6

	TASK CHARACTERISTICS													
	Visual Accessibility		Manual Accessibility		Clarity of Necessary Task Steps		Clarity of Techniques to Perform Task Steps		Special Tools Required		Formal Specs Required		Operational Check Required	
Types of Information Sought	Easy n=26	Hard n=39	Easy n=16	Hard n=49	Clear n=25	Unclear n=40	Clear n=18	Unclear n=47	None n=24	One or More n=41	None n=8	One or More n=57	None n=3	One or More n=62
Location/Identification of Components (%)	23	13	31	12	32	7	44	6	37	5	25*	16	0*	18
Technique for a Task Step (%)	35	54	31	51	32	55	22	55	33	54	37*	47	67*	45
Task Steps Required for Completion (%)	15	15	6	18	16	15	6	19	17	15	25*	14	0*	16
Formal Specification Data (%)	27	18	31	18	20	22	28	19	12	27	12*	23	33*	21

*Caution: Percentage in this cell based on less than 10 cases

BASELINE DATA, MOS 638/C, 1978-80

RELATIVE FREQUENCY OF INFORMATION SEEKING EVENTS - TYPE BY SOURCE
(Percent of Total Events At Each Level of Task Characteristic)

SOURCE: PRINTED MATERIAL

PRIOR TASK EXPERIENCE LEVEL: NONE

Types of Information Sought	TASK CHARACTERISTICS													
	Visual Accessibility		Manual Accessibility		Clarity of Necessary Task Steps		Clarity of Techniques to Perform Task Steps		Special Tools Required		Formal Specs Required		Operational Check Required	
	Easy n=12	Hard n=50	Easy n=12	Hard n=50	Clear n=31	Unclear n=31	Clear n=14	Unclear n=48	None n=27	One or More n=35	None n=23	One or More n=39	None n=4	One or More n=50
Location/Identification of Components (%)	8	8	8	8	6	10	0	10	11	6	22	0	0*	9
Technique for a Task Step (%)	42	28	33	30	35	26	21	33	37	26	35	28	50*	29
Task Steps Required for Completion (%)	33	36	25	38	35	35	36	35	30	40	22	44	25*	36
Formal Specification Data (%)	17	28	33	24	23	29	43	21	22	29	22	28	25*	26

*Caution: Percentage in this cell based on less than 10 cases.

BASELINE DATA, MOS 638/C, 1978/80

RELATIVE FREQUENCY OF INFORMATION SEEKING EVENTS – TYPE BY SOURCE
(Percent of Total Events of Each Task Type)

SOURCE: PERSON – ASK

PRIOR TASK EXPERIENCE LEVEL: 7 OR MORE

Types of Information Sought	GENERAL TASK TYPES				
	Component Part Replacement n = 11	Preventive Maintenance n = 2	Drivetrain n = 0	Brake n = 33	Suspension and Wheel n = 27
Location/identification of Components (%)	9	0*	-	0	0
Technique for a Task Step (%)	18	50*	-	15	52
Task Steps Required for Completion (%)	18	0*	-	12	19
Formal Specification Data (%)	18	0*	-	0	4
Help on Serviceability Judgement (%)	18	0*	-	67	11
Help on Alignment Judgement (%)	18	50*	-	6	15

* Caution: Percentages in this cell based on less than 10 cases

BASELINE DATA MOS 638/C, 1978-80

RELATIVE FREQUENCY OF INFORMATION SEEKING EVENTS – TYPE BY SOURCE
(Percent of Total Events of Each Task Type)

SOURCE: PERSON – ASK

PRIOR TASK EXPERIENCE LEVEL: 1-6

Types of Information Sought	GENERAL TASK TYPES				
	Component Part Replacement n = 11	Preventive Maintenance n = 10	Drivetrain n = 8	Brake n = 37	Suspension and Wheel n = 27
Location/Identification of Components (%)	9	20	25*	0	26
Technique for a Task Step (%)	64	20	25*	41	30
Task Steps Required for Completion (%)	9	20	0*	5	7
Formal Specification Data (%)	0	20	13*	8	0
Help on Serviceability Judgement (%)	18	10	13*	11	22
Help on Alignment Judgement (%)	0	10	25*	35	15

*Caution: Percentages in this cell based on less than 10 cases

BASLINE DATA MOS 63B/C, 1978-80

RELATIVE FREQUENCY OF INFORMATION SEEKING EVENTS – TYPE BY SOURCE
(Percent of Total Events of Each Task Type)

PRIOR TASK EXPERIENCE LEVEL: NONE

SOURCE: PERSON – ASK

Types of Information Sought	GENERAL TASK TYPES				
	Component Part Replacement n = 21	Preventive Maintenance n = 13	Drivetrain n = 7	Brake n = 14	Suspension and Wheel n = 38
Location/Identification of Components (%)	5	23	0*	0	8
Technique for a Task Step (%)	33	38	43*	79	58
Task Steps Required for Completion (%)	19	31	29*	14	11
Formal Specification Data (%)	10	0	14*	7	3
Help on Serviceability Judgement (%)	29	0	14*	0	8
Help on Alignment Judgement (%)	5	8	0*	0	13

*Caution: Percentage in this cell based on less than 10 cases

BASELINE DATA, MOS 638/C, 1978-80

RELATIVE FREQUENCY OF INFORMATION SEEKING EVENTS -- TYPE BY SOURCE
(Percent of Total Events of Each Task Type)

SOURCE: PERSON -- DISCUSS

PRIOR TASK EXPERIENCE LEVEL: 7 OR MORE

Types of Information Sought	GENERAL TASK TYPES				
	Component Part Replacement n = 20	Preventive Maintenance n = 1	Drivetrain n = 1	Brake n = 25	Suspension and Wheel n = 17
Location/Identification of Components (%)	5	0*	0*	0	0
Technique for a Task Step (%)	50	100*	100*	52	76
Task Steps Required for Completion (%)	40	0*	0*	28	12
Formal Specification Data (%)	0	0*	0*	8	0
Help on Serviceability Judgement (%)	0	0*	0*	12	0
Help on Alignment Judgement (%)	5	0*	0*	0	12

*Caution: Percentage in this cell based on less than 10 cases

BASELINE DATA, MOS 638/C, 1978-80

RELATIVE FREQUENCY OF INFORMATION SEEKING EVENTS - TYPE BY SOURCE
(Percent of Total Events of Each Task Type)

SOURCE: PERSON - DISCUSS

PRIOR TASK EXPERIENCE LEVEL: 1-6

Types of Information Sought	GENERAL TASK TYPES				
	Component Part Replacement n = 8	Preventive Maintenance n = 10	Drivetrain n = 2	Brake n = 12	Suspension and Wheel n = 6
Location/Identification of Components (%)	0*	20	0*	0	0*
Technique for a Task Step (%)	75*	80	100*	58	83*
Task Steps Required for Completion (%)	25*	0	0*	33	0*
Formal Specification Data (%)	0*	0	0*	8	0*
Help on Serviceability Judgment (%)	0*	0	0*	0	17*
Help on Alignment Judgment (%)	0*	0	0*	0	0*

*Caution: Percentages in this cell based on less than 10 cases

BASELINE DATA, MOS 638/C, 1978-80

RELATIVE FREQUENCY OF INFORMATION SEEKING EVENTS - TYPE BY SOURCE
(Percent of Total Events of Each Task Type)

SOURCE: PERSON - DISCUSS

PRIOR TASK EXPERIENCE LEVEL: NONE

Types of Information Sought	GENERAL TASK TYPES				
	Component Part Replacement n = 18	Preventive Maintenance n = 6	Drivetrain n = 1	Brake n = 4	Suspension and Wheel n = 21
Location, Identification of Components (%)	11	17*	0*	0*	0
Technique for a Task Step (%)	78	50*	0*	50*	67
Task Steps Required for Completion (%)	11	33*	0*	25*	33
Formal Specification Data (%)	0	0*	100*	25*	0
Help on Serviceability Judgment (%)	0	0*	0*	0*	0
Help on Alignment Judgment (%)	0	0*	0*	0*	0

* Caution: Percentage in this cell based on less than 10 cases

BASELINE DATA, MOS 63B/C, 1978-80

RELATIVE FREQUENCY OF INFORMATION SEEKING EVENTS - TYPE BY SOURCE
(Percent of Total Events of Each Task Type)

SOURCE: PRINTED MATERIAL

PRIOR TASK EXPERIENCE LEVEL: 7 OR MORE

Types of Information Sought	GENERAL TASK TYPES				
	Component Part Replacement n = 0	Preventive Maintenance n = 2	Drivetrain n = 0	Brake n = 4	Suspension and Wheel n = 10
Location Identification of Components (%)	0*	0*	0*	0*	0
Technique for a Task Step (%)	0*	0*	0*	0*	70
Task Steps Required for Completion (%)	0*	50*	0*	25*	10
Formal Specification Data (%)	0*	50*	0*	75*	20

*Cells with Percentages in this cell contain less than 10% data

BASELINE DATA, MOS 638/C, 1978-80

RELATIVE FREQUENCY OF INFORMATION SEEKING EVENTS — TYPE BY SOURCE
(Percent of Total Events of Each Task Type)

SOURCE: PRINTED MATERIAL

PRIOR TASK EXPERIENCE LEVEL: 1-6

Types of Information Sought	GENERAL TASK TYPES				
	Component Part Replacement n = 15	Preventive Maintenance n = 14	Drivetrain n = 4	Brake n = 20	Suspension and Wheel n = 12
Location Identification of Components (%)	20	0	75*	0	42
Technique for a Task Step (%)	33	57	0*	65	33
Task Steps Required for Completion (%)	33	0	0*	15	17
Formal Specification Data (%)	13	43	25*	20	8

*Caution: Percentage in this cell based on less than 10 cases

BASELINE DATA, MOS 638/C, 1978 80

RELATIVE FREQUENCY OF INFORMATION SEEKING EVENTS – TYPE BY SOURCE
(Percent of Total Events of Each Task Type)

SOURCE: PRINTED MATERIAL

PRIOR TASK EXPERIENCE LEVEL: NONE

Types of Information Sought	GENERAL TASK TYPES				
	Component Part Replacement n = 10	Preventive Maintenance n = 8	Drivetrain n = 3	Brake n = 24	Suspension and Wheel n = 17
Location/Identification of Components (%)	30	13*	0*	4	0
Technique for a Task Step (%)	10	50*	0*	29	41
Task Steps Required for Completion (%)	10	25*	67*	46	35
Formal Specification Data (%)	50	13*	33*	21	24

*Caution: Percentage in this cell based on less than 10 cases

BASELINE DATA, MOS 63B/C, 1978-80

RELATIVE FREQUENCY OF PROCESS ERROR EVENTS, LISTED BY MAJOR ERROR TYPE
(Percent of Total Events At Each Level of Task Characteristic)

PRIOR TASK EXPERIENCE LEVEL: 7 OR MORE

ALL PERSONS

Type of Error	TASK CHARACTERISTICS													
	Visual Accessibility		Manual Accessibility		Clarity of Necessary Task Steps		Clarity of Techniques to Perform Task Steps		Special Tools Required		Formal Specs Required		Operational Check Required	
	Easy n=151	Hard n=189	Easy n=118	Hard n=222	Clear n=162	Unclear n=178	Clear n=94	Unclear n=246	None n=96	One or More n=244	None n=91	One or More n=249	None n=71	One or More n=269
Violate Good Mechanical Practice (%)	7	10	7	9	8	9	9	9	8	9	7	10	7	9
Wrong Technique Used (%)	21	23	22	22	24	20	15	25	6	28	24	21	27	21
Specification Errors (%)	19	26	17	26	20	25	22	23	10	28	0	31	17	25
Wrong Part/Component (%)	11	5	11	6	13	3	14	6	10	7	12	6	10	7
Wrong Order of Steps (%)	26	16	28	17	21	20	27	18	34	15	30	17	24	20
Wrong Position or Orientation of Part/Component (%)	11	6	9	7	9	7	7	8	7	8	7	8	15	6
Wrong Adjustment Technique (%)	5	14	6	12	4	15	6	11	23	5	21	6	0	13

*Caution: Percentage in this cell based on less than 10 cases.

BASELINE DATA, MGS 63B.C, 1978-80

RELATIVE FREQUENCY OF PROCESS ERROR EVENTS, LISTED BY MAJOR ERROR TYPE
(Percent of Total Events At Each Level of Task Characteristic)

PRIOR TASK EXPERIENCE LEVEL: 1-6

ALL PERSONS

Type of Error	TASK CHARACTERISTICS													
	Visual Accessibility		Manual Accessibility		Clarity of Necessary Task Steps		Clarity of Techniques to Perform Task Steps		Special Tools Required		Formal Specs Required		Operational Check Required	
	Easy n=110	Hard n=169	Easy n=77	Hard n=202	Clear n=126	Unclear n=153	Clear n=84	Unclear n=195	None n=80	One or More n=199	None n=63	One or More n=216	None n=45	One or More n=234
Violate Good Mechanical Practice (%)	8	8	9	8	10	7	6	9	14	6	6	9	11	8
Wrong Technique Used (%)	16	22	14	22	18	21	19	20	12	23	21	19	20	20
Specification Errors (%)	31	18	34	19	29	18	35	18	12	28	0	30	27	23
Wrong Part/Component (%)	15	7	8	11	12	8	13	9	18	7	16	8	4	11
Wrong Order of Steps (%)	17	24	21	22	17	25	18	23	16	24	27	20	29	20
Wrong Position or Orientation of Part/Component (%)	6	8	5	8	9	6	7	7	6	8	6	7	9	7
Wrong Adjustment Technique (%)	6	12	9	10	4	15	2	13	21	5	24	6	0	12

*Caution: Percentage in this cell based on less than 10 cases

BASeLINE DATA MOS 63B/C, 1978-80

RELATIVE FREQUENCY OF PROCESS ERROR EVENTS, LISTED BY MAJOR ERROR TYPE
(Percent of Total Events At Each Level of Task Characteristic)

PRIOR TASK EXPERIENCE LEVEL: NONE

ALL PERSONS

Type of Error	TASK CHARACTERISTICS													
	Visual Accessibility		Manual Accessibility		Clarity of Necessary Task Steps		Clarity of Techniques to Perform Task Steps		Special Tools Required		Formal Specs Required		Operational Check Required	
	Easy n=75	Hard n=107	Easy n=50	Hard n=132	Clear n=82	Unclear n=100	Clear n=54	Unclear n=128	None n=48	One or More n=134	None n=41	One or More n=141	None n=44	One or More n=138
Violate Good Mechanical Practice (%)	11	5	10	6	9	6	6	8	4	8	5	8	14	5
Wrong Technique Used (%)	16	33	14	30	17	33	13	31	17	29	20	28	34	23
Specification Errors (%)	20	21	14	23	17	24	19	22	6	26	0	27	18	22
Wrong Part/Component (%)	5	9	6	8	9	7	7	8	15	5	15	6	7	8
Wrong Order of Steps (%)	25	21	32	19	24	21	22	23	35	18	46	16	14	25
Wrong Position or Orientation of Part/Component (%)	11	9	14	8	13	7	17	7	12	9	12	9	14	9
Wrong Adjustment Technique (%)	12	2	10	5	11	2	17	2	10	4	2	7	0	8

*Caution: Percentage in this cell based on less than 10 cases

BASELINE: TA, MOS 63b/C, 1978-80
**RELATIVE FREQUENCY OF PROCESS ERROR EVENTS FOR OBSERVATIONS WITH
 ONE OR MORE INFORMATION SEEKING EVENTS, LISTED BY MAJOR ERROR TYPE**
 (Percent of Total Events At Each Level of Task Characteristic)

PRIOR TASK EXPERIENCE LEVEL: 7 OR MORE

SEEKERS	TASK CHARACTERISTICS													
	Visual Accessibility		Manual Accessibility		Clarity of Necessary Task Steps		Clarity of Techniques to Perform Task Steps		Special Tools Required		Formal Specs Required		Operational Check Required	
	Easy n=59	Hard n=73	Easy n=47	Hard n=85	Clear n=66	Unclear n=66	Clear n=30	Unclear n=102	None n=35	One or More n=97	None n=40	One or More n=92	None n=31	One or More n=101
Type of Error														
Violate Good Mechanical Practice (%)	7	11	6	11	11	8	10	9	6	10	7	10	13	8
Wrong Technique Used (%)	27	29	32	26	33	23	13	32	9	35	35	25	35	26
Specification Errors (%)	17	25	15	25	20	23	23	21	11	25	0	30	13	24
Wrong Part/Component (%)	10	4	11	5	11	3	13	5	14	4	10	5	6	7
Wrong Order of Steps (%)	22	19	21	20	15	26	27	19	43	12	35	14	13	23
Wrong Position or Orientation of Part/Component (%)	12	5	9	8	8	9	7	9	3	10	2	11	19	5
Wrong Adjustment Technique (%)	5	7	6	6	3	9	7	6	14	3	10	4	0	8

*Caution: Percentages in this cell based on less than 10 cases

B. JELINE D. A. NOS 658 C, 1978-80
**RELATIVE FREQUENCY OF SERIOUS UNCORRECTED ERROR EVENTS FOR OBSERVATIONS
 WITH ONE OR MORE INFORMATION SEEKING EVENTS, LISTED BY MAJOR ERROR TYPE**
 (Percent of Total Events At Each Level of Task Characteristic)

PRIOR TASK EXPERIENCE LEVEL: 1-6

SEEKERS	TASK CHARACTERISTICS													
	Visual Accessibility		Manual Accessibility		Clarity of Necessary Task Steps		Clarity of Techniques to Perform Task Steps		Special Tools Required		Formal Specs Required		Operational Check Required	
	Easy n=64	Hard n=135	Easy n=42	Hard n=157	Clear n=83	Unclear n=116	Clear n=48	Unclear n=151	None n=65	One or More n=134	None n=43	One or More n=156	None n=13	One or More n=186
Type of Error														
Violate Good Mechanical Practice (%)	8	8	10	8	11	6	4	9	12	6	5	9	15	8
Wrong Technique Used (%)	16	20	14	20	17	20	19	19	12	22	19	19	23	18
Specification Errors (%)	39	17	43	19	35	16	48	17	15	28	0	31	46	23
Wrong Part/Component (%)	17	6	7	10	12	8	15	8	14	7	12	9	8	10
Wrong Order of Steps (%)	8	26	14	22	12	26	6	25	15	22	28	18	0	22
Wrong Position or Orientation of Part/Component (%)	3	9	0	9	8	6	4	8	6	7	7	7	8	7
Wrong Adjustment Technique (%)	9	14	12	13	5	18	4	15	25	7	30	8	0	13

*Caution: Percentages in this cell based on less than 10 cases

EASELINE DATA, M-638/C, 1978-80
**RELATIVE FREQUENCY OF PROCESS ERROR EVENTS FOR OBSERVATIONS WITH
 ONE OR MORE INFORMATION SEEKING EVENTS, LISTED BY MAJOR ERROR TYPE**
 (Percent of Total Events At Each Level of Task Characteristic)

PRIOR TASK EXPERIENCE LEVEL: NONE

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SEEKERS	TASK CHARACTERISTICS													
	Visual Accessibility		Manual Accessibility		Clarity of Necessary Task Steps		Clarity of Techniques to Perform Task Steps		Special Tools Required		Formal Specs Required		Operational Check Required	
	Easy n=53	Hard n=104	Easy n=33	Hard n=124	Clear n=60	Unclear n=97	Clear n=40	Unclear n=117	None n=33	One or More n=124	None n=24	One or More n=133	None n=40	One or More n=117
Violate Good Mechanical Practice (%)	11	5	9	6	8	6	5	8	6	7	4	8	12	5
Wrong Technique Used (%)	13	32	9	30	13	33	12	30	12	29	8	29	38	21
Specification Errors (%)	23	22	21	23	20	24	20	23	6	27	0	26	15	25
Wrong Part/Component (%)	6	9	6	8	10	6	7	8	15	6	17	6	7	8
Wrong Order of Steps (%)	21	21	27	19	20	22	16	23	33	18	58	14	12	24
Wrong Position or Orientation of Part/Component (%)	9	10	12	9	13	7	17	7	12	9	8	10	15	8
Wrong Adjustment Technique (%)	17	2	15	5	15	2	22	2	15	5	4	8	0	9

*Caution: Percentage in this cell based on less than 10 cases

BASELINE DATA, MCS 638 C, 1978-80
**RELATIVE FREQUENCY OF PROCESS ERROR EVENTS FOR OBSERVATIONS WITH
 NO INFORMATION SEEKING EVENTS, LISTED BY MAJOR ERROR TYPE**
 (Percent of Total Events at Each Level of Task Characteristic)

PRIOR TASK EXPERIENCE LEVEL: 7 OR MORE

NON-SEEKERS

Type of Error	TASK CHARACTERISTICS													
	Visual Accessibility		Manual Accessibility		Clarity of Necessary Task Steps		Clarity of Techniques to Perform Task Steps		Special Tools Required		Formal Specs Required		Operational Check Required	
	Easy n=92	Hard n=116	Easy n=71	Hard n=137	Clear n=96	Unclear n=112	Clear n=64	Unclear n=144	None n=61	One or More n=147	None n=51	One or More n=157	None n=40	One or More n=168
Violate Good Mechanical Practice (%)	8	9	7	9	6	10	8	8	10	7	6	9	2	10
Wrong Technique Used (%)	16	20	15	20	18	19	16	19	5	24	16	19	20	18
Specification Errors (%)	21	27	18	27	21	27	22	25	10	30	0	32	20	25
Wrong Part/Component (%)	12	6	11	7	15	4	14	6	8	9	14	7	12	8
Wrong Order of Steps (%)	29	14	32	15	25	17	27	18	30	17	25	19	33	18
Wrong Position or Orientation of Part/Component (%)	10	6	10	7	10	5	8	8	10	7	10	7	12	7
Wrong Adjustment Technique (%)	4	19	6	16	5	19	6	15	28	6	29	7	0	15

*Caution: Percentages in this table based on less than 10 cases.

BASELINE DATA, MUS 63B-C, 1978-80
**RELATIVE FREQUENCY OF PROCESS ERROR EVENTS FOR OBSERVATIONS WITH
 NO INFORMATION SEEKING EVENTS, LISTED BY MAJOR ERROR TYPE**
 (Percent of Total Events at Each Level of Task Characteristic)

PRIOR TASK EXPERIENCE LEVEL: 1-6

NON-SEEKERS	TASK CHARACTERISTICS													
	Visual Accessibility		Manual Accessibility		Clarity of Necessary Task Steps		Clarity of Techniques to Perform Task Steps		Special Tools Required		Formal Specs Required		Operational Check Required	
	Easy n=46	Hard n=34	Easy n=35	Hard n=45	Clear n=43	Unclear n=37	Clear n=36	Unclear n=44	None n=15	One or More n=65	None n=20	One or More n=60	None n=32	One or More n=48
Violate Good Mechanical Practice (%)	9	9	9	9	9	8	8	9	20	6	10	8	9	8
Wrong Technique Used (%)	17	29	14	29	21	24	19	25	13	25	25	22	19	25
Specification Errors (%)	20	24	23	20	19	24	17	25	0	26	0	28	19	23
Wrong Part Component (%)	11	12	9	13	12	11	11	11	33	6	25	7	3	17
Wrong Order of Steps (%)	30	18	29	22	28	22	33	18	20	26	25	25	41	15
Wrong Position or Orientation of Part/Component (%)	11	3	11	4	9	5	11	5	7	8	5	8	9	6
Wrong Adjustment Technique (%)	2	6	6	2	2	5	0	7	7	3	10	2	0	6

*Citation: Percentage in this cell based on less than 10 cases

BASLINE DATA, MOS 638/C. 30

**RELATIVE FREQUENCY OF PROCESS ERROR EVENTS FOR OBSERVATIONS WITH
NO INFORMATION SEEKING EVENTS, LISTED BY MAJOR ERROR TYPE**
(Percent of Total Events at Each Level of Task Characteristic)

PRIOR TASK EXPERIENCE LEVEL: NONE

NON-SEEKERS

Type of Error	TASK CHARACTERISTICS													
	Visual Accessibility		Manual Accessibility		Clarity of Necessary Task Steps		Clarity of Techniques to Perform Task Steps		Special Tools Required		Formal Specs Required		Operational Check Required	
	Easy n= 22	Hard n= 3	Easy n= 17	Hard n= 8	Clear n= 22	Unclear n= 3	Clear n= 14	Unclear n= 11	None n= 15	One or More n=10	None n= 17	One or More n= 8	None n= 4	One or More n= 21
Violate Good Mechanical Practice (%)	9	0*	12	0*	9	0*	7	9	0	20	6	12*	25*	5
Wrong Technique Used (%)	23	67*	24	38*	27	33*	14	45	27	30	35	12*	0*	33
Specification Errors (%)	14	0*	0	38*	9	33*	14	0	7	20	0	38*	50*	5
Wrong Part/Component (%)	5	33*	6	12*	5	33*	7	9	13	0	12	0*	0*	10
Wrong Order of Steps (%)	36	0*	41	12*	36	0*	43	13	40	20	29	38*	25*	33
Wrong Position or Orientation of Part/Component (%)	14	0*	18	0*	14	0*	14	9	13	10	18	0*	0*	14
Wrong Adjustment Technique (%)	0	0*	0	0*	0	0*	0	0	0	0	0	0*	0*	0

*Caution: Percentage in this cell based on less than 10 cases

B. SELF, ED. TA. MCS 6711 C, 1978-80

RELATIVE FREQUENCY OF PROCESS ERROR EVENTS, LISTED BY MAJOR ERROR TYPE
(Percent of Total Events of Each Task Type)

PRIOR TASK EXPERIENCE LEVEL: 7 OR MORE

ALL PERSONS Type of Error	GENERAL TASK TYPES				
	Component Part Replacement n = 40	Preventive Maintenance n = 53	Drivetrain n = 15	Brake n = 81	Suspension and Wheel n = 151
Violate Good Mechanical Practice (%)	0	6	7	11	11
Wrong Technique Used (%)	12	17	27	10	32
Specification Errors (%)	28	26	20	20	23
Wrong Part/Component (%)	22	9	7	2	7
Wrong Order of Steps (%)	25	23	33	27	14
Wrong Position or Orientation of Part/Component (%)	12	11	0	4	9
Wrong Adjustment Technique (%)	0	8	7	26	5

*Cells with Percentages of zero will be rounded up to zero when 10 or more

BACCHLIN DATA - MCR 43B - 1974-80

RELATIVE FREQUENCY OF PROCESS ERROR EVENTS, LISTED BY MAJOR ERROR TYPE
(Percent of Total Events of Each Task Type)

PRIOR TASK EXPERIENCE LEVEL: 1-6

ALL PERSONS Type of Error	GENERAL TASK TYPES				
	Component Part Replacement n = 68	Preventive Maintenance n = 37	Drivetrain n = 21	Brake n = 65	Suspension and Wheel n = 88
Violate Good Mechanical Practice (%)	4	5	19	15	5
Wrong Technique Used (%)	19	11	19	9	32
Specification Errors (%)	22	22	33	22	24
Wrong Part/Component (%)	16	11	0	6	10
Wrong Order of Steps (%)	24	16	24	20	23
Wrong Position or Orientation of Part/Component (%)	12	11	0	5	6
Wrong Adjustment Technique (%)	3	24	5	23	1

*Caution: Percentages in this table rounded off less than 10 - zero

BATTLE LINE DATA MOS-7B/C 1978-80

RELATIVE FREQUENCY OF PROCESS ERROR EVENTS, LISTED BY MAJOR ERROR TYPE
(Percent of Total Events of Each Task Type)

PRIOR TASK EXPERIENCE LEVEL NONE

ALL PERSONS Type of Error	GENERAL TASK TYPES				
	Component Part Replacement n = 41	Preventive Maintenance n = 16	Drivetrain n = 17	Brake n = 30	Suspension and Wheel n = 78
Violate Good Mechanical Practice (%)	2	6	18	10	6
Wrong Technique Used (%)	10	12	18	27	38
Specification Errors (%)	22	19	23	10	24
Wrong Part Component (%)	7	19	12	7	5
Wrong Order of Steps (%)	44	37	12	27	9
Wrong Position or Orientation of Part/Component (%)	12	0	18	3	12
Wrong Adjustment Technique (%)	2	6	0	17	5

*Certain Percentages in this cell based on less than 10 counts

BASELINE TA, 1056 °C, 178 P

**RELATIVE FREQUENCY OF PROCESS ERROR EVENTS FOR OBSERVATIONS WITH
ONE OR MORE INFORMATION SEEKING EVENTS, LISTED BY MAJOR ERROR TYPE**
(Percent of Total Events of Each Task Type)

PRIOR TASK EXPERIENCE LEVEL: 7 OR MORE

SEEKERS	GENERAL TASK TYPES				
	Component Part Replacement n = 19	Preventive Maintenance n = 7	Drivetrain n = 2	Brake n = 35	Suspension and Wheel n = 69
Violate Good Mechanical Practice (%)	0	14*	0*	9	12
Wrong Technique Used (%)	21	14*	100*	11	38
Specification Errors (%)	11	43*	0*	26	20
Wrong Part/Component (%)	26	0*	0*	3	4
Wrong Order of Steps (%)	37	14*	0*	34	10
Wrong Position or Orientation of Part/Component (%)	5	14*	0*	3	12
Wrong Adjustment Technique (%)	0	0*	0*	14	4

*Caution: Percentages in the cell are 0 on less than 10 cases

BASELINE DATA, 1956-1960, 1979-80

**RELATIVE FREQUENCY OF PROCESS ERROR EVENTS FOR OBSERVATIONS WITH
ONE OR MORE INFORMATION SEEKING EVENTS, LISTED BY MAJOR ERROR TYPE**
(Percent of Total Events of Each Task Type)

PRIOR TASK EXPERIENCE LEVEL: 1-6

SEEKERS	GENERAL TASK TYPES				
Type of Error	Component Part Replacement n = 56	Preventive Maintenance n = 31	Drivetrain n = 11	Brake n = 52	Suspension and Wheel n = 49
Violate Good Mechanical Practice (%)	4	3	18	15	6
Wrong Technique Used (%)	20	13	9	4	39
Specification Errors (%)	23	19	55	25	20
Wrong Part/Component (%)	12	13	0	4	12
Wrong Order of Steps (%)	25	16	18	19	18
Wrong Position or Orientation of Part/Component (%)	12	10	0	6	2
Wrong Adjustment Technique (%)	4	26	0	27	2

* Caution: Percentages in this cell based on less than 10 cases

BASELINE DATA, MCS 63¹ D, 1979-80

**RELATIVE FREQUENCY OF PROCESS ERROR EVENTS FOR OBSERVATIONS WITH
ONE OR MORE INFORMATION SEEKING EVENTS, LISTED BY MAJOR ERROR TYPE**
(Percent of Total Events of Each Task Type)

PRIOR TASK EXPERIENCE LEVEL: NONE

SEEKERS Type of Error	GENERAL TASK TYPES				
	Component Part Replacement n = 33	Preventive Maintenance n = 11	Drivetrain n = 13	Brake n = 26	Suspension and Wheel n = 74
Violate Good Mechanical Practice (%)	3	9	15	12	5
Wrong Technique Used (%)	6	9	23	23	38
Specification Errors (%)	27	18	15	12	26
Wrong Part/Component (%)	9	9	15	8	5
Wrong Order of Steps (%)	42	45	8	23	9
Wrong Position or Orientation of Part/Component (%)	9	0	23	4	11
Wrong Adjustment Technique (%)	3	9	0	19	5

*Caution: Percentage in this cell based on less than 10 cases.

BAS. LINE. DAT. MOC 038/C. 1978 80

**RELATIVE FREQUENCY OF PROCESS ERROR EVENTS FOR OBSERVATION WITH
NO INFORMATION SEEKING EVENTS, LISTED BY MAJOR ERROR TYPE**
(Percent of Total Events of Each Task Type)

PRIOR TASK EXPERIENCE LEVEL: 7 OR MORE

NON-SEEKERS	GENERAL TASK TYPES				
	Component Part Replacement n = 21	Preventive Maintenance n = 46	Drivetrain n = 13	Brake n = 46	Suspension and Wheel n = 82
Violate Good Mechanical Practice (%)	0	4	8	13	10
Wrong Technique Used (%)	5	17	15	9	28
Specification Errors (%)	43	24	23	15	24
Wrong Part/Component (%)	19	11	8	2	9
Wrong Order of Steps (%)	14	24	38	22	17
Wrong Position or Orientation of Part/Component (%)	19	11	0	4	6
Wrong Adjustment Technique (%)	0	9	8	35	6

* Caution: Percentages in this cell based on less than 10 cases

BASLINE DATA, MOS 63B C, 1978-80

**RELATIVE FREQUENCY OF PROCESS ERROR EVENTS FOR OBSERVATION WITH
NO INFORMATION SEEKING EVENTS, LISTED BY MAJOR ERROR TYPE
(Percent of Total Events of Each Task Type)**

PRIOR TASK EXPERIENCE LEVEL: 1-6

NON-SEEKERS	GENERAL TASK TYPES				
Type of Error	Component Part Replacement n = 12	Preventive Maintenance n = 6	Drivetrain n = 10	Brake n = 13	Suspension and Wheel n = 39
Violate Good Mechanical Practice (%)	8	17*	20	15	3
Wrong Technique Used (%)	17	0*	30	31	23
Specification Errors (%)	17	33*	10	8	28
Wrong Part/Component (%)	33	0*	0	15	8
Wrong Order of Steps (%)	17	17*	30	23	28
Wrong Position or Orientation of Part/Component (%)	8	17*	0	0	10
Wrong Adjustment Technique (%)	0	17*	10	8	0

*Caution: Percentage in this cell based on less than 10 cases

BASIC LINE, ATA MOS 38/C 1978 80
**RELATIVE FREQUENCY OF PROCESS ERROR EVENTS FOR OBSERVATION WITH
 NO INFORMATION SEEKING EVENTS, LISTED BY MAJOR ERROR TYPE**
 (Percent of Total Events of Each Task Type)

PRIOR TASK EXPERIENCE LEVEL: NONE

NON-SEEKERS	GENERAL TASK TYPES				
	Component Part Replacement n = 8	Preventive Maintenance n = 5	Drivetrain n = 4	Brake n = 4	Suspension and Wheel n = 4
Violate Good Mechanical Practice (%)	0*	0*	25*	0*	25*
Wrong Technique Used (%)	25*	20*	0*	50*	50*
Specification Errors (%)	0*	20*	50*	0*	0*
Wrong Part/Component (%)	0*	40*	0*	0*	0*
Wrong Order of Steps (%)	50*	20*	25*	50*	0*
Wrong Position or Orientation of Part/Component (%)	25*	0*	0*	0*	25*
Wrong Adjustment Technique (%)	0*	0*	0*	0*	0*

* Caution: Percentages in this cell based on less than 10 cases

BASILIN DATA MOL 338/C, 1978 80

**RELATIVE FREQUENCY OF SERIOUS UNCORRECTED ERROR EVENTS,
LISTED BY MAJOR ERROR TYPE**

(Percent of Total Events At Each Level of Task Characteristic)

ALL PERSONS

PRIOR TASK EXPERIENCE LEVEL: 7 OR MORE

Type of Error	TASK CHARACTERISTICS													
	Visual Accessibility		Manual Accessibility		Clarity of Necessary Task Steps		Clarity of Techniques to Perform Task Steps		Special Tools Required		Formal Specs Required		Operational Check Required	
	Easy n= 70	Hard n= 95	Easy n= 54	Hard n= 111	Clear n= 82	Unclear n= 83	Clear n= 52	Unclear n= 113	None n= 40	One or More n= 125	None n= 37	One or More n= 128	None n= 35	One or More n= 130
Violate Good Mechanical Practice (%)	0	1	0	1	0	1	0	1	0	1	0	1	0	1
Wrong Technique Used (%)	11	22	13	20	15	20	8	22	5	22	14	19	23	16
Specification Errors (%)	44	49	37	52	40	54	42	50	20	56	0	61	37	50
Wrong Part Component (%)	19	0	19	3	16	0	17	4	18	5	24	3	6	8
Wrong Order of Steps (%)	19	5	22	5	15	7	23	5	18	9	22	8	31	5
Wrong Position or Orientation of Part Component (%)	1	1	2	1	1	1	2	1	3	1	0	2	3	1
Wrong Adjustment Technique (%)	6	21	7	18	13	16	8	18	37	7	41	7	0	18

*Caution: Percentage in this cell based on less than 10 cases

BASFLINE DATA MOS 63B/C, 1978 80

**RELATIVE FREQUENCY OF SERIOUS UNCORRECTED ERROR EVENTS,
LISTED BY MAJOR ERROR TYPE**
(Percent of Total Events At Each Level of Task Characteristic)

ALL PERSONS

PRIOR TASK EXPERIENCE LEVEL: 1-6

Type of Error	TASK CHARACTERISTICS													
	Visual Accessibility		Manual Accessibility		Clarity of Necessary Task Steps		Clarity of Techniques to Perform Task Steps		Special Tools Required		Formal Specs Required		Operational Check Required	
	Easy n= 63	Hard n= 76	Easy n= 48	Hard n= 91	Clear n= 80	Unclear n= 59	Clear n= 53	Unclear n= 86	None n= 39	One or More n= 100	None n= 25	One or More n= 114	None n= 23	One or More n= 116
Violate Good Mechanical Practice (%)	2	3	2	2	2	2	0	3	8	0	12	0	0	3
Wrong Technique Used (%)	10	24	10	21	10	27	13	20	10	20	8	19	13	18
Specification Errors (%)	54	38	54	41	49	41	53	41	28	52	0	55	39	47
Wrong Part/Component (%)	16	8	6	14	14	8	13	10	15	10	20	10	4	13
Wrong Order of Steps (%)	16	4	21	3	13	5	19	4	3	12	4	11	43	3
Wrong Position or Orientation of Part/Component (%)	0	3	0	2	1	2	0	2	0	2	0	2	0	2
Wrong Adjustment Technique (%)	3	21	6	16	11	15	2	20	36	4	56	4	0	16

*Caution: Percentage in this cell based on less than 10 cases

BASE LINE DATA, MCS 63B C, 1978 80
**RELATIVE FREQUENCY OF SERIOUS UNCORRECTED ERROR EVENTS,
 LISTED BY MAJOR ERROR TYPE**
 (Percent of Total Events At Each Level of Task Characteristic)

PRIOR TASK EXPERIENCE LEVEL: NONE

ALL PERSONS

Type of Error	TASK CHARACTERISTICS													
	Visual Accessibility		Manual Accessibility		Clarity of Necessary Task Steps		Clarity of Techniques to Perform Task Steps		Special Tools Required		Formal Specs Required		Operational Check Required	
	Easy n=33	Hard n=40	Easy n=23	Hard n=50	Clear n=33	Unclear n=40	Clear n=24	Unclear n=49	None n=18	One or More n=55	None n=7	One or More n=66	None n=15	One or More n=58
Violate Good Mechanical Practice (%)	0	8	4	4	6	3	4	4	6	4	14*	3	7	3
Wrong Technique Used (%)	6	13	9	10	3	15	0	14	0	13	0*	11	7	10
Specification Errors (%)	39	58	30	58	36	60	33	57	17	60	0*	55	53	48
Wrong Part/Component (%)	9	10	13	8	12	8	13	8	22	5	43*	6	7	10
Wrong Order of Steps (%)	21	8	22	10	18	10	17	12	28	9	29*	12	27	10
Wrong Position or Orientation of Part/Component (%)	0	3	0	2	0	3	0	2	0	2	0*	2	0	2
Wrong Adjustment Technique (%)	24	2	22	8	24	3	33	2	28	7	14*	12	0	16

*Caution: Percentages in this cell based on less than 10 cases

BASELINE DATA, MOS 638 C, 1978-80

**RELATIVE FREQUENCY OF PROCESS ERROR EVENTS FOR OBSERVATIONS WITH
ONE OR MORE INFORMATION SEEKING EVENTS, LISTED BY MAJOR ERROR TYPE**
(Percent of Total Events At Each Level of Task Characteristic)

PRIOR TASK EXPERIENCE LEVEL: 7 OR MORE

SEEKERS	TASK CHARACTERISTICS													
	Visual Accessibility		Manual Accessibility		Clarity of Necessary Task Steps		Clarity of Techniques to Perform Task Steps		Special Tools Required		Formal Specs Required		Operational Check Required	
	Easy n=24	Hard n=25	Easy n=17	Hard n=32	Clear n=23	Unclear n=26	Clear n=9	Unclear n=40	None n=8	One or More n=41	None n=10	One or More n=39	None n=10	One or More n=39
Type of Error														
Violate Good Mechanical Practice (%)	0	0	0	0	0	0	0*	0	0*	0	0	0	0	0
Wrong Technique Used (%)	13	36	18	28	26	23	0*	30	0*	29	40	21	40	21
Specification Errors (%)	50	56	41	59	48	58	56*	53	38*	56	0	67	40	56
Wrong Part Component (%)	17	0	18	3	17	0	22*	5	38*	2	30	3	0	10
Wrong Order of Steps (%)	13	8	12	9	9	12	22*	8	25*	7	30	5	20	8
Wrong Position or Orientation of Part Component (%)	0	0	0	0	0	0	0*	0	0*	0	0	0	0	0
Wrong Adjustment Technique (%)	8	0	12	0	0	8	0*	5	0*	5	0	5	0	5

*Caution: Percentages in this cell based on less than 10 cases

BASELINE DATA MOS 63R C. 1978 80

**RELATIVE FREQUENCY OF SERIOUS UNCORRECTED ERROR EVENTS FOR OBSERVATIONS
WITH ONE OR MORE INFORMATION SEEKING EVENTS, LISTED BY MAJOR ERROR TYPE**
(Percent of Total Events At Each Level of Task Characteristic)

PRIOR TASK EXPERIENCE LEVEL 1-6

SEEKERS	TASK CHARACTERISTICS													
	Visual Accessibility		Manual Accessibility		Clarity of Necessary Task Steps		Clarity of Techniques to Perform Task Steps		Special Tools Required		Formal Specs Required		Operational Check Required	
	Easy N=37	Hard N=60	Easy N=24	Hard N=73	Clear N=51	Unclear N=46	Clear N=53	Unclear N=64	None N=34	One or More N=63	None N=20	One or More N=77	None N=7	One or More N=90
Type of Error														
Violate Good Maintenance Practices (%)	0	2	0	1	0	2	0	2	3	0	5	0	0*	1
Wrong Technique Used (%)	14	20	21	16	12	24	15	19	12	21	10	19	29*	17
Specification Errors (%)	62	38	67	41	55	39	63	39	29	57	0	60	57*	47
Wrong Part Components (%)	22	7	8	14	16	9	18	9	12	13	15	12	14*	12
Wrong Orientation (%)	0	5	0	4	0	7	0	5	3	3	5	3	0*	3
Wrong Position and Orientation of Part Components (%)	0	3	0	3	2	2	0	3	0	3	0	3	0*	2
Wrong Adjustment Technique (%)	3	25	4	21	16	17	3	23	41	3	65	4	0*	18

*Caution: Percentage of observations based on less than 10 cases

BASELINE DATA, MOS 63B C, 1978-80

**RELATIVE FREQUENCY OF SERIOUS UNCORRECTED ERROR EVENTS FOR OBSERVATIONS
WITH ONE OR MORE INFORMATION SEEKING EVENTS, LISTED BY MAJOR ERROR TYPE**
(Percent of Total Events At Each Level of Task Characteristic)

PRIOR TASK EXPERIENCE LEVEL: NONE

SEEKERS	TASK CHARACTERISTICS													
	Visual Accessibility		Manual Accessibility		Clarity of Necessary Task Steps		Clarity of Techniques to Perform Task Steps		Special Tools Required		Formal Specs. Required		Operational Checks Required	
	Easy n=27	Hard n=40	Easy n=20	Hard n=47	Clear n=28	Unclear n=39	Clear n=21	Unclear n=46	None n=15	One or More n=52	None n=5	One or More n=62	None n=13	One or More n=54
Violate Good Mechanical Practice (%)	0	8	5	4	7	3	5	4	7	4	20*	3	8	4
Wrong Technique Used (%)	4	13	5	11	0	15	0	13	0	12	0*	10	3	9
Specification Error (%)	37	58	35	55	36	59	29	59	13	60	0*	53	46	50
Wrong Part Configuration (%)	7	10	10	9	11	8	10	9	20	6	40*	6	8	9
Wrong Piece of Stock (%)	22	8	20	11	18	10	19	11	27	10	20*	13	31	9
Wrong Position, Orientation or Part Component (%)	0	2	0	2	0	3	0	2	0	2	0*	2	0	2
Wrong Adjustment Technique (%)	30	2	25	9	29	3	38	2	33	8	20*	13	0	17

*Caution: Percentage in this cell based on less than 10 cases.

BASELINE DATA, MOS 638 C, 1978-80

**RELATIVE FREQUENCY OF SERIOUS UNCORRECTED ERROR EVENTS FOR OBSERVATIONS
WITH NO INFORMATION SEEKING EVENTS, LISTED BY MAJOR ERROR TYPE**
(Percent of Total Events at Each Level of Task Characteristic)

PRIOR TASK EXPERIENCE LEVEL: 7 OR MORE

55

Type of Error	TASK CHARACTERISTICS													
	Visual Accessibility		Manual Accessibility		Clarity of Necessary Task Steps		Clarity of Techniques to Perform Task Steps		Special Tools Required		Formal Signs Required		Operational Checks Required	
	Easy n=46	Hard n=70	Easy n=37	Hard n=79	Clear n=59	Unclear n=57	Clear n=43	Unclear n=73	None n=32	One or More n=84	None n=27	One or More n=89	None n=25	One or More n=91
Violate Good Mechanical Practice (%)	0	1	0	1	0	2	0	1	0	1	0	1	0	1
Wrong Technique Used (%)	11	17	11	16	10	19	9	18	6	18	4	18	16	14
Specification Errors (%)	41	47	35	49	37	53	40	48	16	56	0	58	36	47
Wrong Part Component (%)	20	0	19	3	15	0	16	3	13	6	22	3	8	8
Wrong Order of Steps (%)	22	4	27	4	17	5	23	4	16	10	19	9	36	4
Wrong Position or Orientation of Part Component (%)	2	1	3	1	2	2	2	1	3	1	0	2	4	1
Wrong Adjustment Technique (%)	4	29	5	25	19	19	9	25	47	8	56	8	0	24

*Caution: Percentages in this table based on less than 10 cases

BASELINE DATA, MCS 63B C, 1978-80

**RELATIVE FREQUENCY OF SERIOUS UNCORRECTED ERROR EVENTS FOR OBSERVATIONS
WITH NO INFORMATION SEEKING EVENTS, LISTED BY MAJOR ERROR TYPE
(Percent of Total Events at Each Level of Task Characteristic)**

PRIOR TASK EXPERIENCE LEVEL 1-6

NON-SEEKERS

Type of Error	TASK CHARACTERISTICS													
	Visual Accessibility		Manual Accessibility		Clarity of Necessary Task Steps		Clarity of Techniques to Perform Task Steps		Special Tools Required		Forms/Spreadsheets Required		Operational Checks Required	
	Easy n=26	Hard n=16	Easy n=24	Hard n=18	Clear n=29	Unclear n=13	Clear n=20	Unclear n=22	None n=5	One or More n=37	None n=5	One or More n=37	None n=16	One or More n=26
Violate Good Manufacturing Practice (GMP)	4	6	4	6	7	0	0	10	40*	0	40*	0	0	8
Wrong Technique Used (%)	4	38	0	39	7	38	10	23	0*	19	0*	19	6	23
Specification Errors (%)	42	38	42	39	38	46	35	45	20*	43	0*	46	31	46
Wrong Part Component (%)	8	13	4	17	10	8	5	14	40*	5	40*	5	0	15
Assembly Discrepancies (%)	38	0	42	0	34	0	50	0	0*	27	0*	27	63	0
Wrong Position or Orientation of Part Component (%)	0	0	0	0	0	0	0	0	0*	0	0*	0	0	0
Wrong Adjustment Technique (%)	4	6	8	0	3	8	0	0	0*	5	20*	0	0	8

*Custom - Percentage in this cell is not an integer

BASELINE DATA, MOS 63B C, 1978-80

**RELATIVE FREQUENCY OF SERIOUS UNCORRECTED ERROR EVENTS FOR OBSERVATIONS
WITH NO INFORMATION SEEKING EVENTS, LISTED BY MAJOR ERROR TYPE**
(Percent of Total Events at Each Level of Task Characteristic)

PRIOR TASK EXPERIENCE LEVEL: NONE

NON-SEEKERS	TASK CHARACTERISTICS													
	Visual Accessibility		Manual Accessibility		Clarity of Necessary Task Steps		Clarity of Techniques to Perform Task Steps		Special Tools Required		Formal Specs Required		Operational Check Required	
	Easy n=6	Hard n=0	Easy n=3	Hard n=3	Clear n=5	Unclear n=1	Clear n=3	Unclear n=3	None n=3	One or More n=3	None n=2	One or More n=4	None n=2	One or More n=4
Violate Good Mechanical Practice (%)	0*	-	0*	0*	0*	0*	0*	0*	0*	0*	0*	0*	0*	0*
Wrong Technique Used (%)	17*	-	33*	0*	20*	0*	0*	33*	0*	33*	0*	25*	0*	25*
Specification Errors (%)	50*	-	0*	100*	40*	100*	67*	33*	33*	67*	0*	75*	100*	25*
Wrong Part/Component (%)	17*	-	33*	0*	20*	0*	33*	0*	33*	0*	50*	0*	0*	25*
Wrong Order of Steps (%)	17*	-	33*	0*	20*	0*	0*	33*	33*	0*	50*	0*	0*	25*
Wrong Position or Orientation of Part/Component (%)	0*	-	0*	0*	0*	0*	0*	0*	0*	0*	0*	0*	0*	0*
Wrong Adjustment Technique (%)	0*	-	0*	0*	0*	0*	0*	0*	0*	0*	0*	0*	0*	0*

*Caution: Percentage in this cell based on less than 10 cases

BASELINE DATA, MOS 63B C, 1978-80

**RELATIVE FREQUENCY OF SERIOUS UNCORRECTED ERROR EVENTS,
LISTED BY MAJOR ERROR TYPE**
(Percent of Total Events of Each Task Type)

PRIOR TASK EXPERIENCE LEVEL: 7 OR MORE

ALL PERSONS

Type of Error	GENERAL TASK TYPES				
	Component Part Replacement n = 20	Preventive Maintenance n = 23	Drivetrain n = 8	Brake n = 41	Suspension and Wheel n = 73
Violate Good Mechanical Practice (%)	0	0	0*	0	*1
Wrong Technique Used (%)	0	4	25*	12	29
Specification Errors (%)	60	61	50*	37	45
Wrong Part Component (%)	35	13	13*	0	3
Wrong Order of Steps (%)	5	9	13*	12	12
Wrong Position or Orientation of Part Component (%)	0	0	0*	2	1
Wrong Adjustment Technique (%)	0	13	0*	37	8

*Caution: Percentage in this cell based on less than 10 cases

BASELINE DATA, MOS 63B C, 1978-80

**RELATIVE FREQUENCY OF SERIOUS UNCORRECTED ERROR EVENTS,
LISTED BY MAJOR ERROR TYPE
(Percent of Total Events of Each Task Type)**

ALL PERSONS

PRIOR TASK EXPERIENCE LEVEL: 1-6

Type of Error	GENERAL TASK TYPES				
	Component Part Replacement	Preventive Maintenance	Drivetrain	Brake	Suspension and Wheel
	n = 30	n = 13	n = 8	n = 33	n = 55
Violate Good Mechanical Practice (%)	7	0	0*	3	0
Wrong Technique Used (%)	10	0	13*	0	36
Specification Errors (%)	53	62	75*	42	35
Wrong Part, Component (%)	17	15	0*	9	11
Wrong Order of Steps (%)	3	0	13*	3	18
Wrong Position or Orientation of Part, Component (%)	7	0	0*	0	0
Wrong Adjustment Technique (%)	3	23	0*	42	0

*Caution: Percentage in this cell based on less than 10 cases

BASELINE DATA MOS 638 C 1978 80

**RELATIVE FREQUENCY OF SERIOUS UNCORRECTED ERROR EVENTS,
LISTED BY MAJOR ERROR TYPE
(Percent of Total Events of Each Task Type)**

ALL PERSONS

PRIOR TASK EXPERIENCE LEVEL: NONE

Type of Error	GENERAL TASK TYPES				
	Component Part Replacement n = 13	Preventive Maintenance n = 7	Drivetrain n = 6	Brake n = 11	Suspension and Wheel n = 36
Violate Good Mechanical Practice (%)	0	0*	0*	9	6
Wrong Technique Used (%)	0	0*	0*	0	19
Specification Errors (%)	85	43*	67*	18	44
Wrong Part Component (%)	8	14*	17*	9	8
Wrong Order of Steps (%)	8	29*	17*	18	11
Wrong Position or Orientation of Part Component (%)	0	0*	0*	0	3
Wrong Adjustment Technique (%)	0	14*	0*	45	8

*Caution: Percentage in this cell based on less than 10 cases

BASELINE DATA, MOS 638 C, 1978-80

**RELATIVE FREQUENCY OF SERIOUS UNCORRECTED ERROR EVENTS FOR OBSERVATIONS
WITH ONE OR MORE INFORMATION SEEKING EVENTS, LISTED BY MAJOR ERROR TYPE
(Percent of Total Events of Each Task Type)**

PRIOR TASK EXPERIENCE LEVEL: 7 OR MORE

SEEKERS	GENERAL TASK TYPES				
Type of Error:	Component Part Replacement n = 8	Preventive Maintenance n = 3	Drivetrain n = 1	Brake n = 14	Suspension and Wheel n = 23
Violate Good Mechanical Practice (%)	0*	0*	0*	0	0
Wrong Technique Used (%)	0*	0*	100*	21	35
Specification Errors (%)	38*	100*	0*	64	48
Wrong Part/Component (%)	50*	0*	0*	0	0
Wrong Order or Steps (%)	13*	0*	0*	14	9
Wrong Position or Orientation of Part/Component (%)	0*	0*	0*	0	0
Wrong Adjustment Technique (%)	0*	0*	0*	0	9

*Caution: Percentage in this cell based on less than 10 cases

BASLINE DATA MOS 63B C, 1978-80

**RELATIVE FREQUENCY OF SERIOUS UNCORRECTED ERROR EVENTS FOR OBSERVATIONS
WITH ONE OR MORE INFORMATION SEEKING EVENTS, LISTED BY MAJOR ERROR TYPE**
(Percent of Total Events of Each Task Type)

PRIOR TASK EXPERIENCE LEVEL: 1-6

SEEKERS Type of Error	GENERAL TASK TYPES				
	Component Part Replacement n = 25	Preventive Maintenance n = 10	Drivetrain n = 6	Brake n = 29	Suspension and Wheel n = 27
Violate Good Mechanical Practice (%)	4	0	0*	0	0
Wrong Technique Used (%)	12	0	17*	0	48
Specification Errors (%)	56	60	83*	45	30
Wrong Part/Component (%)	12	20	0*	7	19
Wrong Order of Steps (%)	4	0	0*	3	4
Wrong Position or Orientation of Part/Component (%)	8	0	0*	0	0
Wrong Adjustment Technique (%)	4	20	0*	45	0

*Caution: Percentage in this cell based on less than 10 cases

BASELINE DATA, MOS 67R C, 1978-80

**RELATIVE FREQUENCY OF SERIOUS UNCORRECTED ERROR EVENTS FOR OBSERVATIONS
WITH ONE OR MORE INFORMATION SEEKING EVENTS, LISTED BY MAJOR ERROR TYPE
(Percent of Total Events of Each Task Type)**

PRIOR TASK EXPERIENCE LEVEL: NONE

SEEKERS	GENERAL TASK TYPES				
	Component Part Replacement n = 12	Preventive Maintenance n = 5	Drivetrain n = 4	Brake n = 11	Suspension and Wheel n = 35
Violate Good Mechanical Practice (%)	0	0*	0*	9	6
Wrong Technique Used (%)	0	0*	0*	0	17
Specification Errors (%)	92	40*	50*	18	46
Wrong Part Component (%)	8	0*	25*	9	9
Wrong Order of Steps (%)	0	40*	25*	18	11
Wrong Position or Orientation of Part Component (%)	0	0*	0*	0	3
Wrong Adjustment Technique (%)	0	20*	0*	45	9

*Caution: Percentage in this cell based on less than 10 cases

BASELINE DATA, MOS 638 C, 1978-80

**RELATIVE FREQUENCY OF SERIOUS UNCORRECTED ERROR EVENTS FOR OBSERVATION
WITH NO INFORMATION SEEKING EVENTS, LISTED BY MAJOR ERROR TYPE
(Percent of Total Events of Each Task Type)**

PRIOR TASK EXPERIENCE LEVEL: 7 OR MORE

NON-SEEKERS	GENERAL TASK TYPES				
	Component Part Replacement	Preventive Maintenance	Drivetrain	Brake	Suspension and Wheels
	n = 12	n = 20	n = 7	n = 27	n = 50
Violate Good Mechanical Practice (%)	0	0	0*	0	2
Wrong Technique Used (%)	0	5	14*	7	26
Specification Errors (%)	75	55	57*	22	44
Wrong Part Component (%)	25	15	14*	0	4
Wrong Order of Steps (%)	0	10	14*	11	14
Wrong Position or Orientation of Part Component (%)	0	0	0*	4	2
Wrong Adjustment Technique (%)	0	15	0*	56	8

*Caution: Percentage in this cell based on less than 10 cases

BASFLINE DATA MOS 638 C 1978-80

**RELATIVE FREQUENCY OF SERIOUS UNCORRECTED ERROR EVENTS FOR OBSERVATION
WITH NO INFORMATION SEEKING EVENTS, LISTED BY MAJOR ERROR TYPE
(Percent of Total Events of Each Task Type)**

PRIOR TASK EXPERIENCE LEVEL: 1-6

NON-SEEKERS	GENERAL TASK TYPES				
	Component Part Replacement n = 5	Preventive Maintenance n = 3	Drivetrain n = 2	Brake n = 4	Suspension and Wheel n = 28
Violate Good Mechanical Practice (%)	20*	0*	0*	25*	0
Wrong Technique Used (%)	0*	0*	0*	0*	25
Specification Errors (%)	40*	67*	50*	25*	39
Wrong Part Component (%)	40*	0*	0*	25*	4
Wrong Order of Steps (%)	0*	0*	50*	0*	32
Wrong Position or Orientation of Part Component (%)	0*	0*	0*	0*	0
Wrong Adjustment Technique (%)	0*	33*	0*	25*	0

*Caution: Percentage in this cell based on less than 10 cases

BASFLINE DATA MOS 638 C 1978-80

**RELATIVE FREQUENCY OF SERIOUS UNCORRECTED ERROR EVENTS FOR OBSERVATION
WITH NO INFORMATION SEEKING EVENTS, LISTED BY MAJOR ERROR TYPE
(Percent of Total Events of Each Task Type)**

PRIOR TASK EXPERIENCE LEVEL: NONE

NON-SEEKERS Type of Error	GENERAL TASK TYPES				
	Component Part Replacement n = 1	Preventive Maintenance n = 2	Drivetrain n = 2	Brake n = 0	Suspension and Wheel n = 1
Violate Good Mechanical Practice (%)	0*	0*	0*	-	0*
Wrong Technique Used (%)	0*	0*	0*	-	100*
Specification Errors (%)	0*	50*	100*	-	0*
Wrong Part Component (%)	0*	50*	0*	-	0*
Wrong Order of Steps (%)	100*	0*	0*	-	0*
Wrong Position or Orientation of Part Component (%)	0*	0*	0*	-	0*
Wrong Adjustment Technique (%)	0*	0*	0*	-	0*

* Caution: Percentages in this table are based on less than 10 cases.

GLOSSARY OF TERMS

MECHANICS' TASK EXPERIENCE

Prior Task Experience - the number of times the mechanic reported having previously performed the same or similar work assignment. The three levels (7 or more times; 1 to 6, none) were formed using Multiple Discriminant Function techniques.

TASK CHARACTERISTICS

General - ratings made during the front-end analysis performed for each task prior to conduct of the observations. These ratings, with the exception of Operational Checkout Required, are defined in Figure 1.

Operational Checkout Required - A yes/no rating made after the observation was completed. Determination of when a checkout was required before considering an assignment successfully completed depended on such things as the scope of the mechanic's work assignment (for example, only to remove a component), availability of replacement parts, and the operational status of the vehicle apart from the mechanic's assignment.

Levels of Task Characteristics - each of the four task characteristics rated on the five-point scale (Figure 1) were divided into two categories by making a median split for the judged difficulty of each based on the ratings for all tasks observed. These two categories are labeled "easy/hard" or "clear/unclear" depending on the particular characteristic. The two levels for the task characteristics rated "yes/no" are simply based on those ratings.

GENERAL TASK TYPES

General - the five listed task types were selected from a number of possible task typologies on the basis of correlational analyses. These task types seemed to clearly group tasks in ways that assisted prediction of information-seeking or error behaviors, yet make meaningful groups in terms of automotive principles.

Component Part Replacement - Examples: remove/install carburetor; remove/install exhaust pipe.

Preventive Maintenance - Examples: tune-up engine; remove/install oil filters.

Drivetrain - Examples: remove/install U-joints; adjust clutch linkage.

Brake - Examples: remove/install wheel cylinders; bleed brakes.

Suspension and Wheel - Examples: remove/install inner axle seal; adjust toe-in; adjust wheel bearings.

INFORMATION DEMAND RATING

Perceptual Dimension

1. Visual Accessibility
- | | | | | |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| 1 | 2 | 3 | 4 | 5 |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| easy | | | | hard |

(Can the part or component to be worked on be seen easily - such as the upper radiator hose? Or is it hard to see - such as the parking brake drum?)

2. Manual Accessibility
- | | | | | |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| 1 | 2 | 3 | 4 | 5 |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| easy | | | | hard |

(Can the part or component to be worked on be gotten to easily - such as the radiator cap? Or is it hard to get to - such as the double spray linkage?)

Cognitive Dimension

1. Clarity of Necessary Task Steps
- | | | | | |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| 1 | 2 | 3 | 4 | 5 |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| clear | | | | unclear |

(Is it clear that something has to be done first - such as removing the spark plug wire before removing spark plug? Or is it unclear whether something has to be done before starting on the central task - such as disconnecting the battery ground before removing an electric fuel pump?)

2. Clarity of Techniques to Perform Task Steps
- | | | | | |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| 1 | 2 | 3 | 4 | 5 |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| clear | | | | unclear |

(Is it clear as to just what needs to be done first - such as removing the distributor cap and rotor before cleaning the breaker points? Or is it unclear, such as which tubes and hoses must be removed before removing the cylinder head?)

Performance Requirements

1. Special Tools Required
- | | |
|--------------------------|--------------------------|
| 0 | 1 |
| <input type="checkbox"/> | <input type="checkbox"/> |
| no | yes |
- (Are any tools required that are not found in the mechanic's common tool box - such as torque wrenches, timing light, feeler gauges?)

2. Formal Specification Required
- | | |
|--------------------------|--------------------------|
| 0 | 1 |
| <input type="checkbox"/> | <input type="checkbox"/> |
| no | yes |
- (Does the task require any close tolerances or fine adjustments - such as torque cylinder head bolts, or adjusting valve tappet clearance?)

Figure Illustration of the Information Demand Rating

INFORMATION-SEEKING EVENTS

General - observed actions of the mechanic directed toward acquiring information to assist in completing the assigned mechanical maintenance task.

Information Sources -

Person-Ask - refers to task relevant information obtained by directly asking a specific question of a supervisor or co-worker.

Person-Discuss - refers to discussions in which the mechanic and one or more persons talk over the task but it is not clear who is requesting or giving information (i.e., information flow directions are confused).

Printed Material - refers to any consulting with technical manuals where there is written, photographic or graphic material presented.

Types of Information Sought -

Location/Identification of Components - Questions about the nomenclature of task-related hardware items and where they are located on the equipment being worked on.

Technique for a Task Step - Questions concerning how to complete the task step presently being performed. Examples include information about how to remove a brake shoe clip, how to detach a universal joint, or special precautions to be followed.

Task Steps Required for Completion - Questions about what the next step in the task is. This type of ISB is distinguished from Technique for a Task Step by whether the question addresses "what to do next?" That is, if the mechanic seeks information about how to successfully complete the action presently engaged in, it is a Technique event. If the mechanic completes a step, then seeks information about what to do next, it is a Task Steps Required for Completion event.

Formal Specification Data - Questions about the range of conditions and indications for a device operating within acceptable limits. Examples of specification information include torque values, electrical values, and pictures of acceptable and unacceptable spark plug conditions.

Help on Serviceability Judgement - Questions about whether or not an equipment part or assembly is serviceable in its present condition. Examples include such questions as, "Are these bearings OK?", or "Can I use this gasket again?"

Help on Alignment Judgement - Questions about whether or not an adjustment has been completed correctly or whether equipment parts or assemblies are correctly positioned (aligned). Examples include such questions as, "Is this the right brake pressure?", or "Is this road wheel on all the way?"

ERROR EVENTS

Process Error Events - actions of the mechanic during task performance, whether or not later corrected, which were not in conformance with US Army doctrine (as defined by Technical Manuals), or which, in the judgment of the observer, did not conform to generally accepted good mechanical practices, or which had negative results in terms of task completion.

Serious Uncorrected Errors - any error which was left uncorrected when the mechanic stated that the job was finished and which, in the opinion of expert mechanics, would result in (a) shortening the serviceable vehicle life, (b) immediately endanger the vehicle, (c) endanger drivers or passengers in the vehicle, and (d) endanger by-standers near the vehicle.

Specific Types of Errors -

Violate Good Mechanical Practices - Errors made when the mechanic violates good general mechanical practice. These are errors which often lead to damaged parts or sloppy workmanship. Examples include improperly greasing wheel bearings, and failing to drain oil reservoir before attempting to change primary oil filter.

Wrong Technique Used - Errors when the mechanic uses the wrong tools or procedure during the task process. Errors of this type often lead to damaged equipment parts. Examples include not using a sling to support heavy equipment parts being removed or installed, and prying with a screwdriver to remove an oil filter element, and damaging the element.

Specification Errors - Process errors made when the mechanic does not follow exact specification requirements stated in the Task Manual. Examples include adjusting contact breaker points to an incorrect gap width, or tightening cylinder head bolts to an incorrect or unknown torque.

Wrong Part/Component - Errors made when an incorrect equipment part is installed, or an attempt is made to install it. Occasions when an equipment part is left out of an assembly are also Parts Errors. Examples include installing a secondary oil filter in the primary filter case, or leaving out part of the U-joint assembly.

Wrong Order of Steps - Errors made when the mechanic does task steps out of their prescribed order. (Occasions when task steps are completely omitted are also Order-of-Steps Error.) Examples include repeated efforts to pull off a brake drum before contracting brake shoes, or repeated attempts to pull out generator before removing all attached wires.

Wrong Position or Orientation of Part/Component - This error usually occurs when equipment parts are installed in such a place or rotated so that they cannot be properly seated and attached. An example is seating an oil cooler in such a position that the inflow/outflow links cannot be attached

Wrong Adjustment Technique - Errors made when the mechanic uses a wrong tool or procedure to complete adjustment of an equipment part. Examples include turning an adjustment the wrong way to tighten/loosen it, and not jacking up a jeep before adjusting the wheel bearings.